

Project Development of Sustainable Date Palm Production Systems in the GCC Countries of the Arabian Peninsula: Objectives, Activities and Major Achievements

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ABSTRACT

The project Development of Sustainable Date Palm Production systems in the GCC Countries of the Arabian Peninsula, is executed in the six GCC countries (Oman, UAE, KSA, Bahrain, Qatar and Kuwait) and financed by the GCC.

The project aims to: Use of Proper agro-management techniques, develop of proper IPM programs against pests and diseases, Development of proper post-harvest techniques to reduce losses, and improve marketing, Characterize and finger prints the major date palm local cultivars, reinforce building of national programs in the area of date palm agro-management and Enhance Networking capabilities for the exchange of information, databases, services derived from the project activities.

The project has 4 technical fields in problem-solving research component (Propagation and Crop Management, Integrated Pest Management, Postharvest and processing and Biotechnology and Genetic Resources conservation). In the Capacity Building component, the project provides specialized training to strength the national agricultural research systems. In the Technology transfer component the project facilitate the transfer and adoption of suitable technologies developed regionally and/or internationally. The approach of the project is based on participative research between farmers and researchers and between the national systems of research (NARS) and the exchange and cooperation between the all GCC countries.

The major achievements of the project are in Field operations are: Applying liquid pollination to facilitate the operation and maintain good level of fruit set ; Selecting bio-pesticides for controlling infestation by borers and mites and identification of some natural enemies for the control of Lesser date Moth ; Ameliorating the quality of dried dates and reducing the loss and the drying time by using Polycarbonate houses) ; Selecting SSR markers to characterize 60 cultivars from GCC countries (10 major cv from each country).

Keywords: GCC, Date Palm, Competitive advantages, competitiveness indices, market share, revealed comparative advantage, trade balance index, dates marketing, Gulf cooperation council (GCC).

INTRODUCTION

The project "Development of sustainable systems of date palm production in the GCC" funded by the General Secretariat of the Arabic Gulf Cooperation Council (GCC) is executed by the International Center for Agricultural Research in the Dry Areas (ICARDA) in the 6 GCC countries: Kingdom of Saudi Arabia, United Arab Emirates, Kingdom of Bahrain, Sultanate of Oman and States of Kuwait and Qatar.

The project activities starts in July 2006 and started its first phase for a period of five years (2006-2011) which enables the achievement of expected results in research areas of date palm systems management and establish an integrated pest management principles and develop postharvest and trading techniques in research on biotechnologies in addition to his success in creating the exchange and integration between countries participating in the development of the date palm, making the project Steering Committee proposes to extend the project activities for the second phase of five years (2013-2017). In the second phase of the project, other than continuous research programs in water supply IPM and Genetic Resources, transfer of technologies for the end users was the main focus on the project.

The present paper presents the project main components in research, capacities building and technology transfer and the major achievements in the field of date palm cropping, production, genetic resources and protection.

MAIN AREAS OF ACTIVITIES OF THE PROJECT

The project contains three complementary axes: (1) Applied research activities of the date palm production systems covering field operations (Crop management), Integrated Pest Management (IPM), Post-harvest operations and Genetic resources; (2) Capacity development and (3) Transfer of technologies.

APPROACH OF THE PROJECT

The project fulfills an approach-based participation and exchange among the six Gulf Countries. For each applied research subject one or more states are the main responsible of the research subject. Other countries can also help of complementary research actions within the exchange with the leader.

The leader of the crop management component is Kuwait, of Integrated Pest Management are Kingdoms of Bahrain and Saudi Arabia, of Post-Harvest and trade are United Arab Emirates and Biotechnologies and of Genetic resources are State Qatar and the Sultanate of Oman.

MAJOR ACCOMPLISHMENTS OF THE PROJECT

Crop management

1. Research of new subsurface irrigation techniques

The subsurface drip irrigation represents the recent improvement of irrigation, because it is considered the most efficient irrigation technique that significantly contribute to reduce water losses of direct evaporation, runoff and deep percolation. The precise application of water and fertilizers resulted in the increased water use efficiency, application uniformity of water and consequently the improvement in crop yield and prevents the growth of weeds around the date palm trees.

Many studies suggest the use of surface drip irrigation as a water saving technology in arid areas, but it is necessary to study and examine the performance and the efficiency of the subsurface drip irrigation in comparison with other irrigation systems such as drip irrigation in these areas. Results of the project on new techniques on date palm irrigation reduce of water supply for date palm by 30-40% water saving without reduction in date production.

2. Date palm pollination

Liquid pollination developed within the project increased efficiency of pollination and better fruit production and this led to increased profitability of farms in addition to reducing the cost of pollination to the farms and the possibility of doing this process to large farms in reduced time than traditional hand pollination. And thus increase the economic returns to palm sector through: reducing the need for trained manpower where one or two operator can do the job, the economy in the amount of liquid pollination needed to less than a quarter of the quantity used in traditional way, short time so it will be possible to pollinate nearly 500 date palm tree during the day. Single action, reducing labor costs, risk of falling during climbing tree to pollinate date palm.

Adoption of liquid pollination technique conducted by some farmers in Sultanate of Oman and UAE reduce outstandingly pollen required quantity, increased the efficiency of pollination and improve the production quality in addition to reducing labor costs and time requirement significantly. Economic study shows a big reduction of the cost reaching 90%.

Pollen extraction and drying and storage conditions was also improved to maintain good vitality using pollen extractor drying chamber and storage facilities in the same unit. The integrated technical pollination package is applied actually in Sultanate Oman and it is expected to develop the same package in other GCC countries.

3. Selection of pollinators

Research actions was conducted in Saudi Arabia to select good pollinators by their effect on date palm production and dates quality to improve quantitative and qualitative characteristics of dates and confirmed the impact of use of some local males on improving date palm productivity. Field surveys were also conducted at several locations in Al Hassa date palm plantations. Good discovered pollinators were planted in the Genetic National Bank in the Date Palm Research Center in Al Hassa.

4. Fruit thinning

Fruit thinning was applied in GCC countries and field tests showed that the ratio of bunches to green leaves is 1 bunch to 8-10 leaves. It showed that is the appropriate proportion to produce good dates. Fruit thinning must be applied 15-20 days after fruit set. Fruit thinning is now conducted in all the research farms in GCC countries.

5- Use of treated waste water on date palm

The use of triple treated water for date palm irrigation carried out in the Kingdom of Bahrain is very encouraging. The analyses showed a lower concentration of pollutants remains particularly heavy elements which is below the maximum allowed. The test results also showed that triple water irrigation treatment did not affect the soil and plants in terms of increasing the level of pollutants. Accordingly, this type of water is a good source for the sustainability of date palm cultivation in dry areas. Bubbler irrigation method proved useless over date palm productivity compared with other techniques such as drip irrigation.

5. Fertigation

Use of fertigation by Hydraulic injector method has significantly increased the date palm productivity by about 70% in comparison to the traditional surface fertilization method for date palm. Fruit weight, date tree production and water productivity were significantly increased by use of fertigation.

6. Use of Mycorrhizae

Mycorrhizae was added to organic fertilizer for seedling date plants under control conditions in UAE conditions. Results showed increased growth of date palm plants fronds by 40% compared to traditional fertilization. In Kuwait, it was found that adding Mycorrhizae with compost sludge increase the date palm growth 24 percent compared to use compost alone and 21 percent without adding compost.

Post-harvest dates

1. Drying dates under polycarbonate rooms

This technology is considered as promising application of solar energy systems in the GCC countries where the losses of production is about 30%. This is with the aim to improve the quality of dried dates, accelerate their drying process, getting cleaner fruits and free from dust. This technology aims to reduce the cost of labor, gaining time and improving the quality of the fruits.

A series of experiments have been conducted to identify the appropriate technical specifications and dimensions of the drying houses to increase the efficiency of this technology. Drying dates inside plastic room was performed for the first time to ameliorate drying process. The quantity of dates to dry was limited and the color was affected because limited aeration of the small plastic houses.

Drying dates using polycarbonate houses shorted the period of drying fruits from 8 to 4 days in addition to improving the quality of dried dates. The pH of dried dates under polycarbonate houses still under the allowed values.

It also improves the quality of dried dates by reduction of insects' infestation which affect the marketing of dates. Dates dried in polycarbonate houses avoid infestation with dust, insects and birds maintaining healthy nutritional benefits of dates. It also improves the quality of the fruit by reducing darkening fruit color.

The polycarbonate drying chambers is one of the promising technologies introduced by the project for the farmers. Expansion of the technique and ameliorating the chambers, need more applied research and efforts.

2. Dates packaging

Studies were conducted to improve dates packaging respecting the packaging standards. Preference of manufacturers (90%) was oriented to easy open packs. In terms of quality of packing, it was noted that the consumer prefers (65%) packed dates under vacuum and (70%) transparent packs. It also demonstrated that most consumers do not prefers metallic and polystyrene pack.

Integrated Pest Management

Excessive use of chemical pesticides in date palm pest control damaged local environment in addition to environmental pollution by toxic pesticides and eliminate the predators. In the other hand the Loss of the date palm production by pest attacks is valued to about 30-40%.

Within this the IPM component of the project was aiming to search for alternatives to chemical pesticides.

Old World Date Dust mite (*Oligonychus afrasiaticus* McGregor) and the lesser date moth (LMD) *Batrachedra amydraula* Meyrick) are considered the dominant acarid pest of date palm in the GCC region is a serious pest of the date palm and causes severe yield loss, particularly in young developing date fruit.

In Oman, the organic-pesticide Coragen 0.15ml/L gave the best results in comparison with the other insecticides on (LDM). In KSA, three bio pesticides (Matrin 0.5%, Paraffin oil, Abamectin 1.8% and Sulfur) and in Bahrain two bio pesticides (Biotrine and Sulfur) gives good results against Dust Palm Mite.

Biological control including the use of biological pesticides, gives good results against the two pests. Exploiting biological control utilizing the egg parasitoid (*Trichogramma cacoeciae* Marchal) was started in KSA and Oman. Efforts have to be undertaken for the multiplication of the parasitoid and its release in field.

Biotechnology and genetic resources

1. Morphological description of major date palm cultivars in GCC countries

Vegetative and fruit description is achieved in the six Gulf countries. The book: Atlas of Major Gulf Countries Date Palm Cultivars is in editing.

Morphological description integrates date palm tree stem, leaves, leaflets and spines. Pomological description is interested to bunches, spikelet's, fruit and seed.

1. Genetic fingerprinting of cultivars

DNA study completed for sixty date palm cultivars collected from all GCC countries: Saudi Arabia, UAE, Bahrain, Oman, Kuwait and Qatar. Thirty ISSR markers were previously selected for genetic characterization.

One program search for genes resistant to environmental stress is started between the project and the Research Centre of the UAE University Al Ain and American University in Abu Dhabi. Promising SNP markers are in identification to undertake GWAS study to map these candidate genes for salinity tolerance in date palm

3. Research of new cultivars and pollinators

In Saudi Arabia 27 screened pollinators developed from date palm seedlings naturally in saline environment Al Ugair Beach and cultivated with some local date palm cultivars offshoots for comparison.

Field surveys were also conducted at several locations in Al Hassa searching good pollinators according to their good effect on quality and productivity in Al Hassa date palm plantations. Good discovered pollinators were planted in the Genetic National Bank in the Date Palm Research Center in Al Hassa.

CONCLUSION

The research efforts of the date palm project team in the 6 GCC Countries through experiments carried out within the framework of the project over the past years in participative research program accomplished some important results in the field of date palm field operations.

The main accomplishments are in date palm water supply. Subsurface irrigation was conducted in 3 countries in different conditions and different techniques. The results are reduction of 35-50 quantity of water within reducing date palm tree growth and production. Date palm pollination was improved using liquid pollination reducing the cost of pollination by increase the efficiency of pollination in addition to reducing the cost of labor hands. Liquid pollination technique reaches 394 farmers and is actually applied in no less than 80 farms, integrating 2 big farms of (12,000 date palm trees) in Kuwait and (200,000 date palm trees) in KSA.

Dates post-harvest operations through drying dates under polycarbonate houses improved the quality of dried dates and reduce notably the losses. This help to raise dates value and

ease their marketing, particularly in coastal production areas with high humidity. Polycarbonate houses are used in about 180 farmers in UAE and Oman.

To reduce chemical effect of chemical pesticides on the nature and improve plant protection the research for alternatives some biological pesticides gives good results against the Old-World Date Dust mite (*Oligonychus afrasiaticus* McGregor) and the lesser date moth (LMD) *Batrachedra amydraula* Meyrick) are considered the dominant acarian pest of date palm in the GCC region. Exploring biological control using parasitoid *Trichogramma cacoeciae* Marchal and predators is started in KSA and Oman. Efforts have to be undertaken for the multiplication of the parasitoid and its release in field.

In the genetic resources characterization and vegetative and fruit description is achieved in the six Gulf countries. Atlas of Major Gulf Countries Date Palm Cultivars is ready for edition and printing. Research for genes resistant to environmental stress in the date palm genome is started between the project and the Research Centre of the UAE University Al Ain and American University in Abu Dhabi. Promising SNP markers are in identification to undertake GWAS study to map these candidate genes for salinity tolerance in date palm.

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